

# Computer Music Research: Present Situation, Future Ideas

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## What is CM Research? A Musical Vision

"I dream of instruments obedient to my thought and which with their contribution of a whole new world of unsuspected sounds, will lend themselves to the exigencies of my inner rhythm." (*Varèse, 1937*)

## What is CM Research? What Research?

**Research:** systematic investigation to establish facts  
**Scientific Research:** research into questions posed by scientific theories and hypotheses

- Most CM Research is really Experimentation, Innovation, ....
- **Types of Research:**
  - Basic/applied
  - Technological/scientific/artistic
  - Interdisciplinary/disciplinary

## What is CM Research?

### Interdisciplinary Research

- **Science:** Development of an hypothesis, the testing of that hypothesis by controlled experimentation or observation, the collection and analysis of data to produce results and the drawing of valid conclusions based on those results.
- **Technology:** Design and development of a solution to a problem and yields a product, process or environment that serves a real need.
- **Art:** Human creation which contains an idea other than its utilitarian purpose.

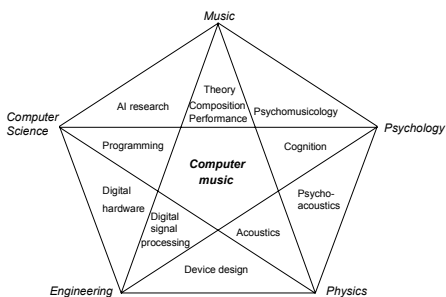
## What is CM Research?

### Evaluation of Interdisciplinary Research

- **Consistency with multiple separate disciplinary antecedents:** the way in which the work stands vis à vis what researchers know and find tenable in the disciplines involved.
- **Balance in weaving together perspectives:** the way in which the work stands together as a generative and coherent whole.
- **Effectiveness in advancing understanding:** the way in which the integration advances the goals that researchers set for their pursuits and the methods they use.

## What is Computer Music Research?

### Disciplines Involved



## State of the Art:

### Active Topics

- Music Generation/Modeling
- Sound Generation/Modeling
- Music Interfaces
- Music Performance Analysis/Synthesis
- Music Understanding/Retrieval

## State of the Art:

### Music Generation/Modeling

- **Approaches coming from different domains:**
  - law (rules)
  - mathematics (mathematical functions)
  - psycho neurology (connectionism)
  - biology (generative processes)
  - ...
- This is mainly Artistic Research: difficult to develop general systems/models

## State of the Art:

### Sound Generation/Modeling

- **Sound Synthesis Goals:**
  - Sound quality
  - Flexibility
  - Generality
  - Usability/Efficiency
- **Active topics:**
  - Physical Models
  - Signal / Spectral Models

## State of the Art:

### Music Performance Analysis/Synthesis

- **Research strategies:**
  - theory-driven vs. data-driven
  - cognitive plausibility vs. computational simplicity
  - perception-oriented vs. production-oriented
- **Approaches:**
  - Measuring performances
  - Analysis-by-synthesis methods
  - Performance models with automatic methods

## State of the Art:

### Music Interfaces

- **Active topics:**
  - Musical mapping algorithms and intelligent controllers
  - Perceptual & cognitive issues in the design of musical controllers
  - Music and motion and/or music and emotion
  - Movement, visual and physical expression with sonic expressivity
  - Novel controllers for collaborative performance
  - Sensor and actuator technologies for musical applications
  - Haptic and force feedback devices

## State of the Art:

### Music Understanding/Retrieval

- Musical feature extraction
- Computational methods for classification, clustering, and modeling
- Measures of musical and perceptual similarity
- Database management and Indexing
- Music perception, cognition, affect, and emotions
- Music analysis and knowledge representation

## Current Context:

### Institutional/Academic

- **Research Centers:**
  - IRCAM (Paris), CCRMA (USA), HUT (Helsinki), Queen Mary (London), Sony-CSL (Paris), University of Genova, KTH (Stockholm), UPF (Barcelona), ...
- **Specialized Education:**
  - Music, Computer Science, ...
- **Conferences:**
  - ICMC, ISMIR, NIME, DAFX, ...
- **Journals:**
  - CMJ, JNMR, ...

## Current Context:

### Industrial/Economic

- **Relevant Industrial Sectors:**
  - Professional audio
  - Musical instruments
  - Computers, internet and audio
  - Radio and broadcasting
  - Multimedia database management
  - Digital music libraries
  - Electronic music and music creation
- The music industry sits at the nexus of cultural, entertainment, leisure and fast moving consumer goods industries

## Current Context:

### Industrial/Economic Issues

- A bigger percentage of the music-related innovation happens in non-music specific companies
- Shift from hardware to software products (no clear business models)
- Crises of record companies
- Problems with Digital Rights Management
- No stable funding venues (EU, Industries, ..)

## Current Context: Social/Cultural

Face it -- The digital revolution is over. Yes, we are no more in the digital age, but the really surprising changes will be elsewhere. (*Nicholas Negroponte, 1998*)

It is failure that guides evolution; perfection offers no incentive for improvement. (*Colson Whitehead, 1999*)

The variety of noises is infinite. If today, when we have perhaps a thousand different machines, we can distinguish a thousand different noises, tomorrow, as new machines multiply, we will be able to distinguish ten, twenty, or thirty thousand different noises, not merely in a simply imitative way, but to combine them according to our imagination. (*Luigi Russolo, 1913*)

## Current Context: Social/Cultural Issues

- Popularization of Music, less demand of high-end music products
- Cultural exchange between nonacademic artists and research centers is lacking
- Shift from traditional Computer Music to new artistic forms: Installations, Software Art, Net-art, Electronica DJs, ...
- Revival of the Futurists movement and John Cage: Post-digital Music, Glitch Music

## Some Keywords for the Future

- Bio-inspired communication systems
- Multimodal interfaces
- Semantic-based knowledge systems
- Networked audiovisual systems and home platforms
- Technology-enhanced learning and access to cultural heritage
- Cognitive systems
- Applications and services for the mobile user
- Cross-media content for leisure and entertainment